

Effect of Acids with Different Chain Lengths Modified by Methane Sulfonic Acid and Temperature on the Properties of Thermoplastic Starch/Glycerin Blends

Authors : Chi-Yuan Huang, Mei-Chuan Kuo, Ching-Yi Hsiao

Abstract : In this study, acids with various chain lengths (C_6 , C_8 , C_{10} and C_{12}) modified by methane sulfonic acid (MSA) and temperature were used to modify tapioca starch (TPS), then the glycerol (GA) were added into modified starch, to prepare new blends. The mechanical properties, thermal properties and physical properties of blends were studied. This investigation was divided into two parts. First, the biodegradable materials were used such as starch and glycerol with hexanedioic acid (HA), suberic acid (SBA), sebacic acid (SA), decanedicarboxylic acid (DA) manufacturing with different temperatures (90, 110 and 130 °C). And then, the solution was added into modified starch to prepare the blends by using single-screw extruder. The FT-IR patterns indicated that the characteristic peak of C=O in ester was observed at 1730 cm^{-1} . It is proved that different chain length acids (C_6 , C_8 , C_{10} and C_{12}) reacted with glycerol by esterification and these are used to plasticize blends during extrusion. In addition, the blends would improve the hydrolysis and thermal stability. The water contact angle increased from 43.0° to 64.0°. Second, the HA (110 °C), SBA (110 °C), SA (110 °C), and DA blends (130 °C) were used in study, because they possessed good mechanical properties, water resistances and thermal stability. On the other hand, the various contents (0, 0.005, 0.010, 0.020 g) of MSA were also used to modify the mechanical properties of blends. We observed that the blends were added to MSA, and then the FT-IR patterns indicated that the C=O ester appeared at 1730 cm^{-1} . For this reason, the hydrophobic blends were produced. The water contact angle of the MSA blends increased from 55.0° to 71.0°. Although break elongation of the MSA blends reduced from the original 220% to 128%, the stress increased from 2.5 MPa to 5.1 MPa. Therefore, the optimal composition of blends was the DA blend (130 °C) with adding of MSA (0.005 g).

Keywords : chain length acids, methane sulfonic acid, Tapioca starch (TPS), tensile stress

Conference Title : ICBN 2017 : International Conference on Biomaterials and Nanomaterials

Conference Location : Zurich, Switzerland

Conference Dates : January 13-14, 2017